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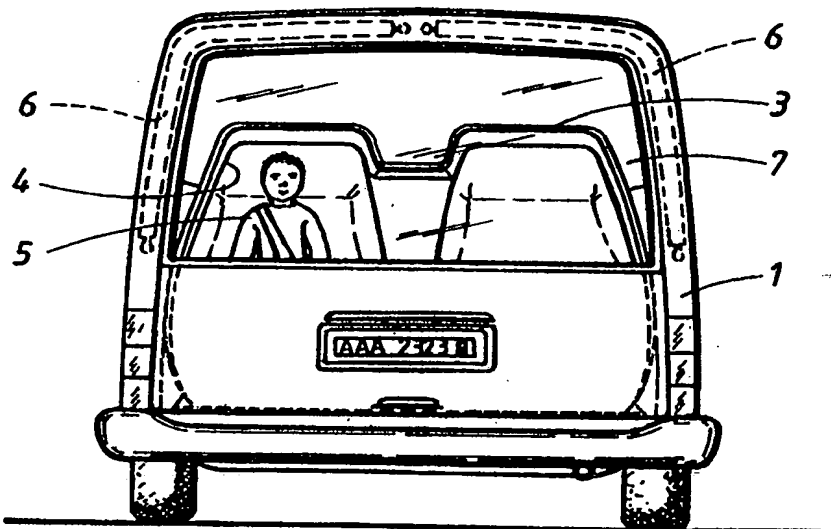
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/SE97/02025 <b>(22) International Filing Date:</b> 4 December 1997 (04.12.97)  <b>(30) Priority Data:</b> 9604466-4 4 December 1996 (04.12.96) SE  <b>(71) Applicant (for all designated States except US):</b> AB VOLVO [SE/SE]; S-405 08 Göteborg (SE).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> SASLECOV, Venti [SE/SE]; Nobelgatan 11A, S-416 57 Göteborg (SE).  <b>(74) Agents:</b> GRAUDUMS, Valdis et al.; Albiñ West AB, P.O. Box 142, S-401 22 Göteborg (SE).		<b>(81) Designated States:</b> BR, CN, JP, KR, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>

**(54) Title:** DEVICE FOR PASSENGER PROTECTION IN A VEHICLE

**(57) Abstract**

The invention relates to a device for protecting passengers (5) in vehicles (1) with at least one seat (4) arranged in connection to the rear part of the vehicle (1), which seat is arranged so that said passenger (5) when travelling in the seat (4) faces said rear part, comprising at least one inflatable element (6; 6'), a sensor for detecting a predetermined collision-like state of the vehicle (1), and means (8) for inflating the element (6; 6') in case of said state. The invention is characterized in that said element (6; 6') in an inactive, non-inflated state is arranged in connection to said rear part and, in an active, inflated state is arranged to assume an extension between said passenger and said rear part. By means of the invention, an improved airbag device for protecting passengers in a rearwards facing extra seat in a vehicle is provided.



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## TITLE:

DEVICE FOR PASSENGER PROTECTION IN A VEHICLE.

## TECHNICAL FIELD:

The present invention relates to a device for protecting the passengers in a vehicle, according to the preamble of appended claim 1. In particular, the invention can be applied in connection with motor vehicles which are equipped with a backwards-facing extra seat for a passenger in the vehicle. The invention also relates to a method for protection of passengers in a vehicle, according to the preamble of appended claim 10.

## BACKGROUND OF THE INVENTION:

In connection with motor vehicles such as passenger cars of the station wagon kind, i.e. a vehicle which comprises a passenger compartment which is integrally shaped with a relatively large rear luggage compartment, it is known from prior art to shape this luggage compartment so that it can house an additional seat. Such an extra seat can then be arranged behind the regular rear seat, and can be so arranged that it faces backwards, i.e. so that a person in the extra seat will sit with his face towards the rear end of the vehicle, and thus have his back towards the front of the vehicle. The purpose of such an extra seat is to utilize the relatively large luggage compartment in a station wagon for transport of passengers as well, in those cases where it is not used for transporting large pieces of cargo.

According to prior art, such an extra seat normally comprises a cushion part and a back rest part which can be arranged detachably or permanently in the luggage compartment. In order to increase the flexibility of the vehicle, the extra seat can be so arranged that its cushion part can be raised when not in use.

Due to the limited amount of space which normally is available in the luggage compartment of a station wagon, the above-mentioned extra seat is normally utilized for passengers with a certain maximum body weight and length, i.e. usually for children and adolescents. A child travelling in such an extra seat is given a raised level of security as compared with, for example, if the child instead had been sitting without a safety belt in the rear seat or in the luggage compartment.

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Although the above-mentioned extra seat thus provides good safety for passengers during transport, it can in connection with certain types of vehicles cause certain problems, particularly regarding protection for passengers in case of collisions or crashes. In particular, when hit from behind there is a risk that parts of the rear structure of the vehicle, for example the rear window, will be pushed into the vehicle in the direction of those sitting in the extra seat. This can of course injure the passengers, for example if the rear window hits the head or torso of the passengers, or if glass shards from the rear window hit the passengers.

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In order to solve the above-mentioned problem, it has previously been attempted to reinforce the structure of the rear part of the vehicle, in order to thus prevent invasion of the luggage compartment when for example being hit from behind. In this way, it is for example possible to try to prevent the rear window of the vehicle from being pushed inwards and hitting a passenger in the extra seat. Although this in principle is an efficient way of solving the above-mentioned problem, it has limits, since it for reasons of cost and design is not possible to reinforce the structure of the body of the vehicle beyond certain limits. This in turn is due to higher demands regarding, for example, the weight of the vehicle and its fuel optimization, thus

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causing demands for new solutions to the said problem as an alternative to only reinforcing the structure of the vehicle which would cause an increased weight of the vehicle.

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SUMMARY OF THE INVENTION:

A main purpose of the present invention is thus to solve the above-mentioned problem, and to provide an improved device for protection of passengers in a rearwards facing seat in a luggage compartment of a motor vehicle. This purpose is achieved by means of a device of the initially mentioned kind, the characteristics of which will become apparent from appended claim 1. This purpose is also achieved by means of a method of the initially mentioned kind, the characteristics of which will become evident from appended claim 10.

The invention is intended to protect passengers in a vehicle which comprises a seat arranged in connection to the rear part of the vehicle in such a way that the passenger, when travelling in the seat, faces said rear part. The invention comprises at least one inflatable element, a sensor for detection of a predetermined collision-like state of the vehicle, and means for inflating the element when said condition is present. The basic principle of the invention is that said element in an inactive, not inflated state, is arranged in connection to said rear part, and in an active inflated state is arranged to assume an extension between said passenger and said rear part. In this way, efficient protection is provided for passengers in an extra seat, by means of which the passenger for example is protected against the rear window and against glass shards. A passenger in the extra seat will also be protected if he is pressed in the direction of the rear part of the vehicle in connection with, for example, being hit from behind.

By means of said inflatable element, a "curtain" is formed by the invention, which covers the rear part of the vehicle and thus forms a barrier which protects the passenger.

5 The inflatable elements according to the invention are in the inactive state preferably arranged as oblong, tube-like units, which are arranged essentially perpendicularly to the longitudinal extension of the vehicle, in connection to its rear part. In this way, the invention only needs small  
10 spaces in an otherwise densely packed part of the vehicle.

Further preferred embodiments will become evident from the appended dependent claims.

15 The terms "extra seat" and "backwards facing extra seat" in this context refer to a seat which is primarily intended for passenger cars of the station wagon kind, and is arranged for passengers which sit facing rearwards, i.e. in the direction of the rear part of the vehicle.

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#### BRIEF DESCRIPTION OF THE DRAWINGS:

The invention will in the following be described in more detail with reference to the appended drawings, in which:

25 Fig. 1 is a side view of a vehicle of the station wagon kind, provided with a rearwards facing extra seat,

Fig. 2 is a view from behind, which shows a vehicle  
30 provided with the present invention according to a first embodiment,

Fig. 3 separately shows an inflatable element intended to be used in connection with the invention,

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Fig. 4 is a view from behind, which corresponds to Fig. 2 but in which the device according to the invention is in an active state,

5 Fig. 5 is a side view of the vehicle according to Fig. 4,

Fig. 6 is a view from behind, which shows a vehicle provided with the present invention according to  
10 a second embodiment, and

Fig. 7 is a view from behind, which corresponds to that shown in Fig. 6 but in which the device according to the invention is in an active state.

15

#### PREFERRED EMBODIMENTS:

Fig. 1 shows a simplified side view of a motor vehicle 1 of the station wagon kind, i.e. a passenger car which is provided with a luggage compartment 2, which is integrally  
20 formed with the passenger compartment, and which in principle consists of the space behind the rear seat 3 of the vehicle 1. The invention is primarily, but not exclusively, intended for this kind of vehicle. In particular, the invention is intended for motor vehicles  
25 which according to Fig. 1 are provided with a special extra seat 4 which is arranged in the luggage compartment 2. The figure also shows the position for a passenger 5 in the extra seat 4. When the passenger 5 sits in the extra seat 4, he is thus travelling facing the rear part of the  
30 vehicle 1.

Arranging an extra seat 4 in the luggage compartment 2 is previously known, and will for that reason not be described in detail here. Due to the shape of the luggage compartment  
35 2, the extra seat 4 is usually suitable for use only by

passengers with low body weight and length, primarily children.

5 Fig. 2 shows a view from behind of the vehicle 1 and the present invention, which according to a first embodiment consists of at least one, preferably two oblong and essentially tube-formed elements 6. These elements 6 consist of inflatable gas bags which are arranged in connection to the rear part of the vehicle 1, and which  
10 will be described in detail below. The rear part of the vehicle 1 is, in a conventional manner, provided with a rear window 7.

15 The figure also indicates the position for the above-mentioned extra seat 4 and a passenger 5 in the extra seat 4.

20 The main objective of the invention is to prevent injuries to passengers 5 in the extra seat 4 when the rear part of the vehicle 1 is compressed, for example when being hit from behind. For this purpose, each bag 6 is so arranged that it can be inflated to a position between the rear window 7 and the passenger 5. As shown separately in Fig. 3, each bag 6 is formed as a tube-like element, which  
25 preferably is made from a stretchable textile material. The bag 6 is, at least in its one end, provided with means for inflating the bag 6. These means preferably consist of a gas generator 8 which is arranged to inflate the bag 6 in the event of a collision. For this purpose, it is connected  
30 to a (not shown) acceleration sensor which, in a known manner, is arranged to detect if an abnormally high retardation takes place. If this happens, the acceleration sensor outputs a signal to the gas generator 8, which in turn is activated so that the bag 6 is inflated. According  
35 to the invention, said acceleration sensor is especially arranged to detect a state where the rear part of the



vehicle 1 is exposed to an acceleration pulse which corresponds to being hit from behind by another vehicle.

Each gas generator 8 is preferably provided with an attachment element 9 for attachment to the body structure of the vehicle 1. Additionally, the bag 6 itself is preferably provided with one or several attachment elements 10 for attachment to the vehicle 1. With renewed reference to Fig. 2, each bag 6 is arranged so that its extension is along the body structure of the vehicle 1, preferably at the side of and above the rear window 7, i.e. in the upper and rear corners of the rear part of the vehicle 1. So as not to negatively influence the appearance of the interior of the vehicle 1, each bag 6 is preferably arranged behind the top and wall panels which cover the inside of the body of the vehicle 1.

Fig. 4 shows a view from behind of the vehicle 1, which is provided with the above-mentioned bags 6, although in an active state in which the bags 6 have been inflated. When a state corresponding to a certain retardation in the rearwards direction of the vehicle 1 is detected by the above-mentioned sensor, a signal will be fed to each gas generator, which in turn will cause them to be triggered. This in turn will mean that each bag 6 will be inflated. Due to the shape of each bag 6, it will be inflated in a direction downwards and inwards, towards the middle of the vehicle, i.e. in the direction of the vertical line of symmetry of the vehicle 1. Additionally the bag 6 is arranged to assume the shape of a curtain (i.e. with a depth or thickness which is essentially smaller than its width and height) which essentially covers that area of the rear window 7 where the head and torso of the passenger 5 otherwise would have been hit by the rear window 7.

The panels in the vehicle 1 behind which each bag 6 is arranged can be provided with rupture lines or the like, in order to facilitate for each bag 6 to exit out into the passenger compartment. Alternatively, the panels can be provided with a (not shown) hatch or door, behind which each bag 6 is arranged. Such a hatch will thus be opened when the bag 6 is inflated.

Fig. 5 shows a side view of the vehicle 1 according to Fig. 4, with a bag 6 in its inflated state. From the figure, it can be seen that the bag 6 is inflated to a position just inside the rear window 7. According to the embodiment, each bag 6 is so shaped that it has a depth (i.e. seen in the longitudinal extension of the vehicle) in the order of size of about 5-8 cm, and a maximal extension from the top of the vehicle in the order of size 30-50 cm. The above-mentioned measurements can however vary according to the application.

Fig. 6 shows a view from behind of the invention according to a further embodiment, which comprises an oblong, essentially tube-shaped element in the form of an inflatable bag 6', which in a manner which corresponds to that described above is arranged in connection to at least one, preferably two, gas generators 8. These gas generators 8 and the bag 6' itself are fixedly attached to the body of the vehicle 1, thus giving the bag 6' an essentially horizontal extension.

Fig. 7 shows a view from behind of the vehicle 1 according to the embodiment shown in Fig. 6, but in an active state, i.e. with the bag 6' inflated. The shape of the bag 6' is such that it is inflated in a direction which is essentially vertical from the top of the vehicle 1 and downwards. In similarity to the above-mentioned embodiment (see Fig. 4), the bag 6' is arranged to assume the shape of

a curtain between the passenger 5 and the rear window 7. In a manner corresponding to that which has been shown in Fig. 5, the bag 6' has an extension from the inside of the rear window 7 and rearwards in the order of size of about 5-8 cm.

The invention is not limited to the described embodiments, but can be varied within the frame of the appended claims. The invention can, for example, be used together with an existing acceleration sensor in the vehicle 1, which can be arranged in the vehicle in order to be used together with a conventional airbag for the front seat of the vehicle 1. Such an existing sensor is then adjusted to detect collisions from behind. Alternatively, the invention can be given a separate acceleration sensor for deactivation of each gas generator 8.

The invention can be utilized in connection with a sensor which detects whether or not somebody is sitting in the extra seat 4. In this way, the bags 6, 6' can be arranged so that they are inflated only if somebody is sitting in the extra seat 4.

The invention can be utilized in different kinds of vehicles, for example station wagons which have a window with an extension along the rear of the vehicle, or in vans and buses with a rear which instead comprises a rear wall.

In a possible variant of the invention, each bag (see Figs. 4 and 7) can be arranged for example at the lower edge of the rear window, and be arranged to be inflated in an essentially upwards direction. In yet another embodiment, the invention can comprise an inflatable bag which is arranged essentially vertically at one side of the vehicle, and which is arranged to expand, when inflated, in a direction away from the side of the vehicle, towards its

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opposite side. This embodiment can also comprise two inflatable bags which are vertically arranged at each side of the vehicle, and arranged to expand so that they meet at the vertical line of symmetry of the vehicle.

## CLAIMS:

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1. Device for protection of passengers (5) in vehicles (1) with at least one seat (4) arranged in connection to the rear part (1) of the vehicle, which seat is arranged so that said passenger (5), when travelling in the seat (4),  
10 faces said rear part, comprising at least one inflatable element (6; 6'), a sensor for detecting a predetermined collision-like state of the vehicle (1) and means (8) for inflating the element (6; 6') in case of said state,  
c h a r a c t e r i z e d i n that said element (6; 6')  
15 in an inactive non-inflated state is arranged in connection to said rear part, and in an active inflated state is arranged to assume an extension between said passenger (5) and said rear part.

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2. Device according to claim 1, wherein said rear part comprises a rear window (7),  
c h a r a c t e r i z e d i n that said element (6; 6')  
is fixedly attached to the body structure of the vehicle (1), where it in said active state constitutes a curtain  
25 between said passenger (5) and said rear window (7).

30

3. Device according to claim 1 or 2,  
c h a r a c t e r i z e d i n that said element (6; 6')  
is arranged, when inflated, to expand in a direction which  
is essentially perpendicular to the longitudinal extension  
of the vehicle (1).

35

4. Device according to any of the previous claims,  
c h a r a c t e r i z e d i n that it comprises two  
inflatable elements (6) which are arranged in connection to  
the two upper and rear corners of said body structure, with  
the elements (6) in said active state expanding away from  
said corners in the direction of the vertical line of  
symmetry of the vehicle (1).

40

5. Device according to any of claims 1-3,  
c h a r a c t e r i z e d i n that it comprises an  
inflatable element (6'), arranged with an essentially  
horizontal extension in connection to said rear part, with  
5 the element (6') in said active state expanding in an  
essentially vertical direction.

6. Device according to claim 5,  
c h a r a c t e r i z e d i n that said inflatable  
10 element (6') is arranged to expand in an upwards direction,  
alternatively in a downwards direction, along said rear  
part.

7. Device according to any of claims 1-3,  
15 c h a r a c t e r i z e d i n that it comprises at least  
one inflatable element arranged with an essentially  
vertical extension in connection to said rear part, with  
said element being arranged to expand in said active state  
in an essentially horizontal direction from the side of the  
20 vehicle (1).

8. Device according to any of the previous claims,  
c h a r a c t e r i z e d i n that said element (6; 6')  
in its inactive state comprises an essentially tube-shaped  
25 component, with said means (8) for inflation being  
connected to at least one end part of said element (6; 6').

9. Device for protecting passengers (5) in a vehicle (1)  
of the station wagon kind which comprises a seat (4)  
30 arranged in the luggage compartment (2) of the vehicle (1),  
which seat faces rearwards, with said passengers (5), when  
travelling in the seat (4), thus facing the rear end part  
of the vehicle (1), comprising at least one inflatable  
element (6; 6'), a sensor for detecting a predetermined  
35 collision-like state of the vehicle (1), and means (8) for  
inflating said element (6; 6') in case of said state,

c h a r a c t e r i z e d i n    t h a t    s a i d    e l e m e n t    ( 6 ; 6 ' )  
i n    a n    i n a c t i v e ,    n o n - i n f l a t e d    s t a t e ,    i s    a r r a n g e d    i n  
c o n n e c t i o n    t o    s a i d    r e a r    e n d    p a r t ,    a n d    i n    a n    a c t i v e    i n f l a t e d  
s t a t e    i s    a r r a n g e d    t o    a s s u m e    a n    e x t e n s i o n    b e t w e e n    s a i d  
5    p a s s e n g e r    ( 5 )    a n d    s a i d    r e a r    e n d    p a r t .

10.    M e t h o d    f o r    p r o t e c t i n g    p a s s e n g e r s    ( 5 )    i n    v e h i c l e s    ( 1 )  
w i t h    a t    l e a s t    o n e    s e a t    ( 4 )    a r r a n g e d    i n    c o n n e c t i o n    t o    t h e  
10    r e a r    p a r t    o f    t h e    v e h i c l e    ( 1 ) ,    s a i d    s e a t    b e i n g    a r r a n g e d    s o  
t h a t    s a i d    p a s s e n g e r    ( 5 )    w h e n    t r a v e l l i n g    i n    t h e    s e a t    ( 4 )  
f a c e s    s a i d    r e a r    p a r t ,    a n d    a t    l e a s t    o n e    i n f l a t a b l e    e l e m e n t  
( 6 ; 6 ' ) ,    c o m p r i s i n g

          d e t e c t i o n    o f    a    p r e d e t e r m i n e d    c o l l i s i o n - l i k e    s t a t e    o f  
t h e    v e h i c l e    ( 1 )    a n d

15           i n f l a t i o n    o f    t h e    e l e m e n t    ( 6 ; 6 ' )    i n    c a s e    o f    s a i d  
s t a t e ,

c h a r a c t e r i z e d i n    t h a t    s a i d    i n f l a t i o n    o f    t h e  
e l e m e n t    ( 6 ; 6 ' )    i s    c o n t r o l l e d    s o    t h a t    t h e    e l e m e n t    ( 6 ; 6 ' )  
a s s u m e s    a n    e x t e n s i o n    b e t w e e n    s a i d    p a s s e n g e r    ( 5 )    a n d    s a i d  
20    r e a r    p a r t .

11.    M e t h o d    a c c o r d i n g    t o    c l a i m    10 ,  
c h a r a c t e r i z e d i n    t h a t    s a i d    i n f l a t i o n    o f    t h e  
e l e m e n t    ( 6 ; 6 ' )    t a k e s    p l a c e    i n    a    d i r e c t i o n    w h i c h    i s  
25    e s s e n t i a l l y    p e r p e n d i c u l a r    t o    t h e    l o n g i t u d i n a l    e x t e n s i o n    o f  
t h e    v e h i c l e    ( 1 ) .

12.    M e t h o d    a c c o r d i n g    t o    c l a i m    10    o r    11 ,  
c h a r a c t e r i z e d i n    t h a t    s a i d    d e t e c t i o n    r e l a t e s  
30    t o    a    s t a t e    w h i c h    c o r r e s p o n d s    t o    a    p r e d e t e r m i n e d    r e t a r d a t i o n  
i n    t h e    r e a r w a r d s    d i r e c t i o n    o f    t h e    v e h i c l e    ( 1 ) .

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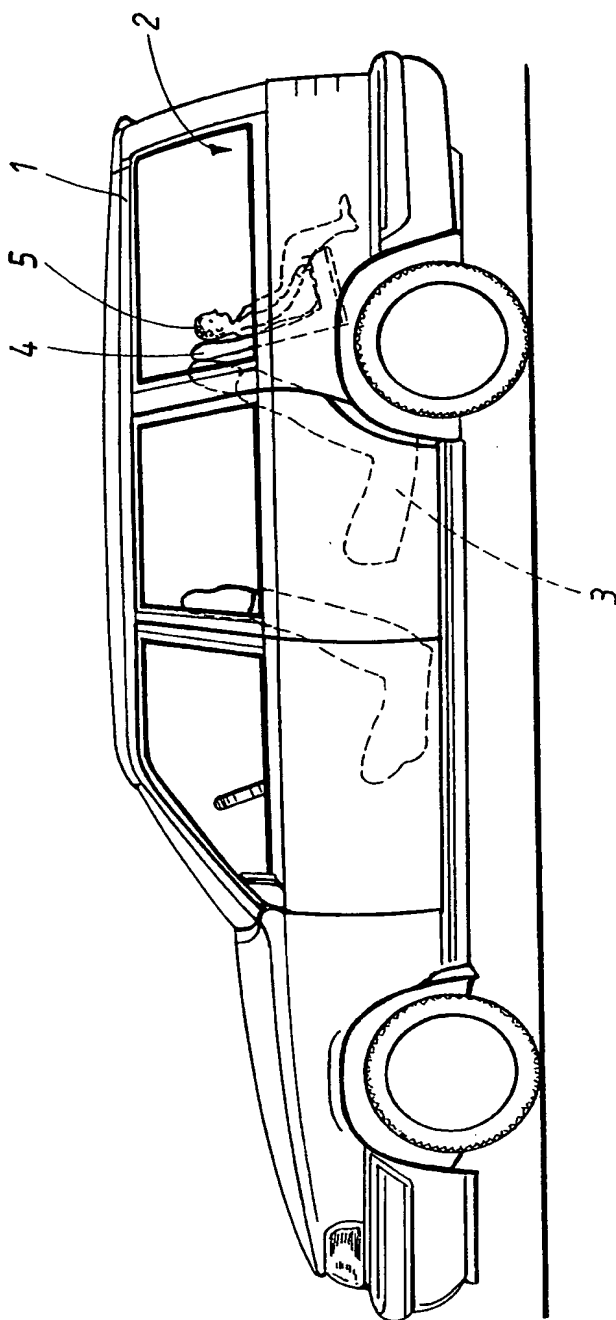


FIG. 1

CONFIRMATION  
COPY



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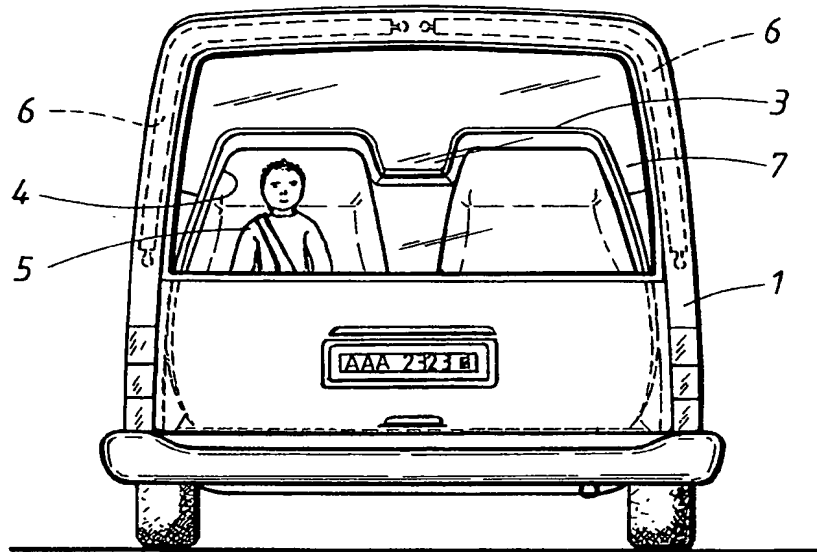


FIG. 2

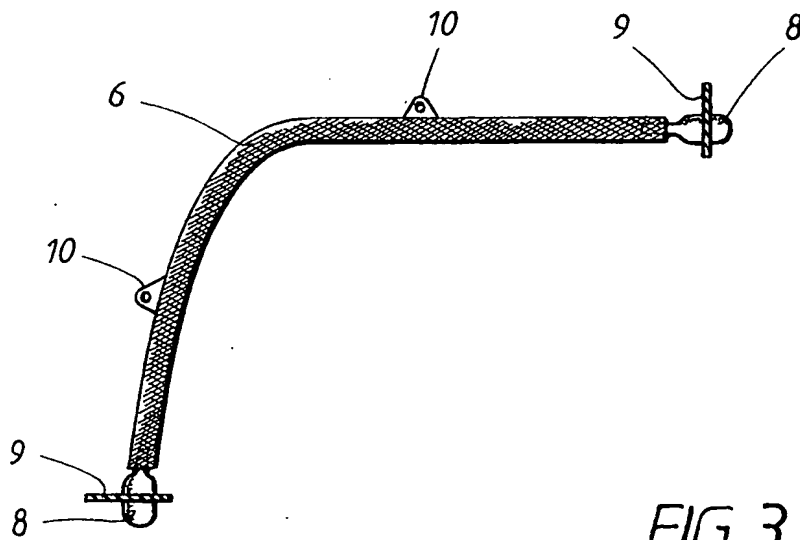


FIG. 3

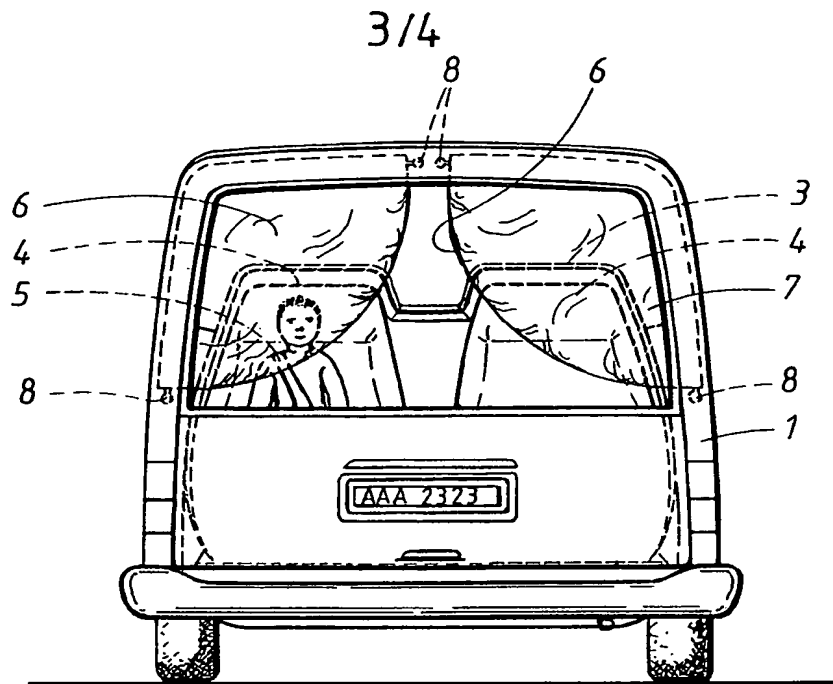


FIG. 4

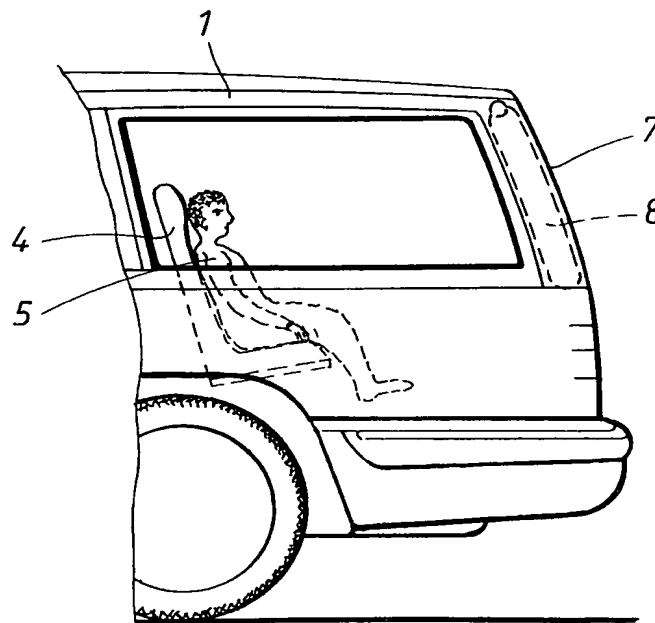


FIG. 5

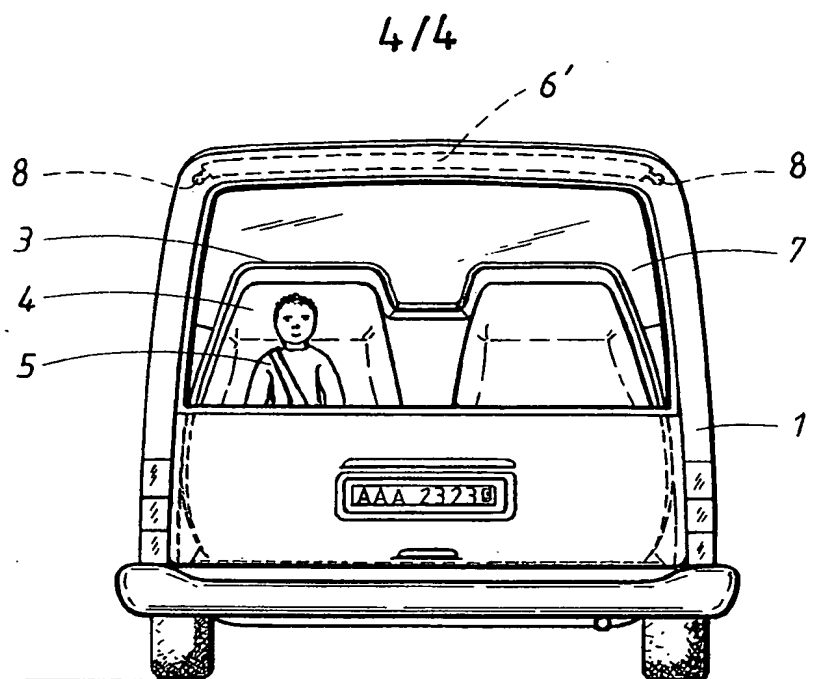


FIG. 6

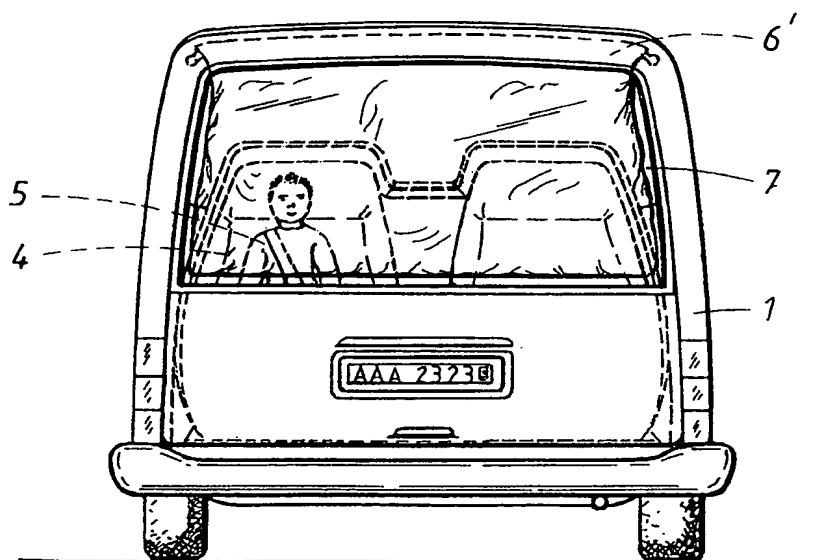


FIG. 7

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/02025

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
<b>IPC6: B60R 21/22</b> According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: B60R		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2834606 A (H.A. BERTRAND), 13 May 1958 (13.05.58), column 3, line 44 - line 58	1-3,5,8
Y	--	6
X	US 3450414 A (YASUSABURO KOBORI), 17 June 1969 (17.06.69), column 5, line 42 - line 51	1,3,7-9
X	GB 1168164 A (SIDNEY OLDSBERG AND WILLIAM RAYMOND), 27 June 1967 (27.06.67), column 3, line 121 - line 127	1-3,7,8
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
18 February 1998		11-03-1998
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International application No.  
PCT/SE 97/02025

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